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A TEST OF BORAX CONTROL OF GOATWEED

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Goatweed (Hypericum perforatum) has infested an estimated 754,000 acres of range and woodlands in Idaho, Montana, and northeastern Washington (1). An aggressive perennial forb spreading by rhizomes and tiny seed produced in abundance, goatweed contains a drug, hypericin, that is toxic to domestic livestock. Unpigmented areas of cattle and sheep feeding upon this plant blister upon exposure to the sun and a scabby condition develops accompanied by restlessness, loss of appetite and weight, and serious emaciation in some instances. Sheep are affected to a lesser extent than cattle, and even with the latter, death is uncommon. Of greater importance, however, is the vast acreage rendered useless to the livestock industry through the almost complete elimination of desirable native forage species.

Extensive efforts to control goatweed have been made since about 1900, both in Australia and the United States. Many attempted control measures have not been successful or have only limited application. Cultivation has given successful results but this method is only applicable to a very small portion of the goatweed-infested areas of this region. Several chemical herbicides have been used effectively in reducing goatweed stands but because of the numerous seeds in the soil, treatment must be repeated for several years to control seedling crops. The cost of chemical control is often prohibitive and frequently exceeds the value of the infested ranges.

A promising method of controlling small, localized goatweed infestations resulted from investigations by the Washington Agricultural Experiment Station. An evaluation of the numerous methods tested on a square-rod basis in these studies indicated early spring application of borax at the rate of four pounds per square rod followed by reseeding to mixtures of crested wheatgrass (Agropyron cristatum) and yellow sweet clover (Melilotus officinalis) or sheep fescue (Festuca ovina) and yellow sweet clover to be the most economical and effective means of control. Boron compounds, while toxic to goatweed plants, did not appear to affect grasses adversely. Further, the residual effects of boron were adequate to eliminate new goatweed seedlings a year or more after application.

Based on these early investigations, the Northern Rocky Mountain Forest and Range Experiment Station, U. S. Forest Service, initiated a field test in 1949 to determine the practicability of the borax method in the control of spot infestations of goatweed and its possible use in holding operations until a more economical and effective method was found. Cooperating in this effort were: Washington Agricultural Experiment Station, Extension Service, Stevens County commissioners, Colville City Council, Soil Conservation Service, and the Colville National Forest.

DESCRIPTION OF AREA

A 20-acre goatweed-infested area in the ponderosa pine-(Pinus ponderosa) bunchgrass type was selected on the south face of Colville Mountain at an elevation of about 2,000 feet. Gradient of slopes within the area varied from 10 to 70 percent. Classified as a Stevens gravelly loam (3), the shallow soil contained varying amounts of gravel and rock fragments. Annual precipitation in this area averaged 16.5 inches.

Vegetation on the area was composed of scattered uneven-aged ponderosa pine, roundleaf snowberry (Symphoricarpos rotundifolia), skunkbush sumac (Rhus trilobata), Spalding rose (Rosa spaldingii), rock spirea (Holodiscus sp.) and several other shrubby species of infrequent occurrence. The understory consisted of goatweed, Wyeth eriogonum (Eriogonum heracleoides), yarrow (Achillea lanulosa), sticky geranium (Geranium viscosissimum), low dogbane (Apocynum pumilum), cinquefoil (Potentilla sp.), moth mullein (Verbascum blattaria), woodland star (Lithophragma bulbifera), sheep sorrel (Rumex acetosella), common dandelion (Taraxacum officinale), rock cress (Arabis sp.), and several other species of minor importance. Grass cover was made up of beardless bluebunch wheatgrass (Agropyron inerme), Idaho fescue (Festuca idahoensis), prairie Junegrass (Koeleria cristata), Kentucky bluegrass (Poa pratensis), cheatgrass (Bromus tectorum), soft brome (Bromus mollis), Sandberg bluegrass (Poa secunda), and subalpine needlegrass (Stipa columbiana), in that order of abundance.

METHODS

The study area was classified into heavy and light goatweed-infested strata. Prior to treatment, an inventory of the vegetation was made within permanently located 1x2 meter sampling units on the two acres reserved as a check plot and the 18 acres to be treated. Four sample plots were established in each strata of the untreated area and 20 in each strata of the area to be treated with borax. The square-foot density method (2) was used to estimate cover on the sampling units. Post-treatment records were obtained in a similar manner.

Commercial borax was applied at the rate of four pounds per square rod with cyclone seeders between May 4 and June 4, 1949. To insure uniform application of the material and to facilitate other work on the area, a grid system which divided the area into 1x2 chain units was used.

Abnormally low precipitation following application of the borax prevented reseeding of the area in the fall of 1949 as originally planned. A mixture of crested wheatgrass, smooth brome (Bromus inermis), hard fescue (Festuca ovina var. duriuscula), yellow sweetclover, and intermediate wheatgrass (Agropyron intermedium) at a 4, 1, 1, 3/4, 1/4 ratio, was finally broadcast at the rate of 10 pounds per acre on April 19 and 20, 1950. No attempt was made to cover the seed.

RESULTS AND CONCLUSIONS

Goatweed cover was reduced by the borax about one half in the heavily infested part of the treated area the first year (table 1). On the treated portion of the lightly infested area goatweed produced about the same amount of cover during this period. Lack of precipitation immediately after borax application is believed to have reduced effectiveness of the borax in controlling goatweed. Three years after treatment, goatweed cover was still less than the pretreatment cover but was more than that observed one year after treatment. On the untreated area, goatweed increased during the three-year period. In the heavily infested portion of the untreated area a one-third reduction of the 1950 goatweed cover occurred by 1952, but during the same period, goatweed produced two-thirds more cover in the light infestation. The observed differences in the two infestations on the untreated area suggest that competition among goatweed plants comprising dense stands resulted in a decline of plant vigor and a general thinning of the goatweed stand.

Grass cover increased on all parts of the study area over the three-year period. The greater increase on the treated area, particularly in the heavy infestation, as compared with the untreated area, was attributed to the release afforded by partial elimination of goatweed. Cheatgrass, soft brome, and beardless bluebunch wheatgrass, in that order, accounted for most of the grass cover increase. Beardless bluebunch wheatgrass appeared to have been stimulated by borax in the second year after treatment as was evidenced by the higher percentage of seedstalk-producing plants and greater leaf and seedstalk heights.

Cover provided by other forbs was less in 1952 than in 1949 throughout the study area. Species response could not be associated with treatment.

Shrub cover declined about equally on the treated and untreated portions of the light and heavy infestations by 1952. Unknown natural causes were presumed responsible for the decline of shrubs where borax was not involved. The lesser total cover provided by shrubs on the untreated area resulted from a general reduction in cover of all species. On the treated area, however, death of snowberry and skunkbush sumac accounted for much of the lesser shrub cover in 1952. All of the sumac and about two-thirds of the snowberry was eliminated, presumably from the effects of borax. Spalding rose, on the other hand, produced about the same amount of cover as before treatment.

Table 1. Average ground cover per sample plot by treatment and infestation class in 1949, 1950, and 1952

	Goatweed	Other forbs	Grasses	Shrubs	Pine seedlings
	Square feet				No.
HEAVY INFESTATION					
Treated					
1949	1.75	0.39	0.44	0.58	16
1950	0.92	0.43	0.32	0.55	9
1952	1.54	0.19	2.51	0.25	2
Untreated					
1949	1.84	0.50	0.34	0.88	0
1950	2.90	0.62	0.27	0.92	0
1952	1.94	0.44	0.70	0.34	0
LIGHT INFESTATION					
Treated					
1949	0.07	0.61	1.11	0.42	19
1950	0.05	0.54	1.09	0.44	2
1952	0.06	0.36	2.34	0.10	0
Untreated					
1949	0.06	1.41	1.02	1.09	1
1950	0.32	1.34	1.22	1.19	0
1952	0.83	1.20	1.47	0.31	0

Ponderosa pine seedlings were apparently rather severely affected by borax. Three years after treatment, pine seedlings on the sample plots were reduced from 16 to 2 and 19 to 0 on the heavy and light infestations, respectively. Examinations one and two years after treatment showed that a burning of the needles of older trees on the area had also occurred. Trees of all ages seemed equally damaged. However, the damage is not likely to be permanent for some recovery was evident in 1952.

Although complete removal and lasting control of goatweed were not obtained in this test, the results plus observations of other trials conducted under more favorable conditions indicate the usefulness of the borax method in controlling goatweed. Admittedly impracticable on a large scale, this means of control has its greatest value in the elimination of small, isolated infestations in inaccessible areas and in holding operations. Isolated infestations have been recently reported for the first time east of the Continental Divide where heretofore the plant has not been known to occur. Prompt control of such infested areas could undoubtedly be more economically and feasibly effected by the borax method than by any other means. If goatweed is to be held to the present area infested, widescale use of the borax method will have to be undertaken on outlying spots in inaccessible or difficult country.

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